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THE ETHICAL VALUE OF SCIENCE

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THE object of scientific study is to learn all that we can concerning ourselves and the universe in which we live, with the aid of the senses and reasoning faculties which were presumably given us to use. Such studies can only enhance our devout admiration and respect for the works of the Creator, yet from the earliest times we find that the devotees of religion and of philosophy, whether pagan or Christian, have looked askance upon the scientist and have challenged his conclusions. Plato in his "Republic" voices contempt for scientific studies in the remark: "If any one undertakes to learn anything of sensible objects, whether he gape upwards or bellow downwards, never at all shall I say that he learns, for I aver that he has no real knowledge of these things, nor shall I say that his soul looks upwards, but downwards, even though he learn lying on his back, either at land or at sea." Throughout the Christian era theological dogma has fought a losing fight against the development of science. To-day the force of this attack is almost spent, but there lingers still in many orthodox minds the hazy belief that the scientist is a materialist who ignores all spiritual values, who is oblivious to beauty in nature, poetry, and art, and whose labors are devoted to devising means for securing material wealth and selfish gratification. Those whose training has been confined to the humanities seem inclined to the view that there was once a golden age when all men were just and generous, enlightened and happy, when religion was pure and undefiled, and that science has destroyed this happy state. Man has eaten of the fruit of the tree of knowledge,

> The fruit of that forbidden tree whose mortal taste
> Brought death into the world and all our woe.

A recent writer in *The Atlantic Monthly* holds science largely responsible for the extirpation of culture, and claims that it has challenged the supereminence of religion, has turned philosophy out of doors, has thrown contempt on all learning not dependent on it, and has purchased support by the bribe of material comforts. Some have attributed the great war to the suppression of spiritual values by the influence of science, and its horrors to malignant investigators who spend their lives in devising agencies of death and destruction. Usually this is suggested by innuendo rather than by specific allegations. As an example, consider the following statement of Stephen Coleridge in the *Saturday Review* for April 7, 1917: "Science never elevated conduct nor aggravated virtue; it never bade any one sacrifice his life for another nor to lead a forlorn hope; it never illumined charity nor condemned cruelty; its one positive perfected concrete human production in the modern world is the German." To the unthinking this rhetorical sophistry produces the effect of a convincing condemnation, whereas all that it really charges is that science has not done certain good things, without specifying any particular evils that it has wrought—except the German by-product. We must remember, however, that the Prussian is not a modern product—that morally he is to-day, in all international relations at least, what he was in the time of Frederick the Great, when there was little science in Prussia. Science has not made him what he is, but it is he who has perverted it to base uses. And what shall we say of the theologians, the clergymen, and the philosophers who have made the Hohenzollern ethics their own? Shall we therefore condemn all philosophy and religion?

Coleridge's statement would be quite as true if we should substitute for the word science the word art or food, neither of which is regarded as antagonistic to the better impulses of human nature. The statement would be quite as true—but how different the implications—if it were worded thus: "Science never degraded conduct nor diminished virtue; it never forbade any one to sacrifice his life for another nor to lead a forlorn hope; it never rebuked intelligent charity nor fostered cruelty." Further, it may be said with truth that science has never burned martyrs at the stake; it has never forbidden the use of the reason given by God to man, nor attempted to throttle human liberty; it has never bribed its disciples with power and wealth; it has never maintained that the end justifies the means nor claimed divine sanction for its evil deeds; it has done none of those things which have made religious dogma so feared and mistrusted that some highly civilized nations do not permit religious instruction in their public schools. We may see all around us the evidence that every implication of Coleridge's statement is untrue; that science does elevate conduct; that it does cultivate the spirit which causes men to lead forlorn hopes and to sacrifice their lives for others; that its whole influence is to foster the clean, the wholesome, and the good in our social life; that it leads inevitably to the condemnation of cruelty and injustice; and the scientific study of history, with overwhelming evidence gathered from the experimental laboratory of human experience, gives the lie to the doctrine that any individual or state can with impunity violate the ethical laws upon which the safety and happiness of mankind depend. This doctrine has often been defended and put into practice by philosophers, theologians, statesmen and those who claim to rule by divine right. It would be impossible to find many scientists of repute throughout human history who inculcated or defended unethical conduct—with one recent exception, when a group of scientists surrendered their reason to a false philosophy of state and appended their names to a famous manifesto likewise signed by theologians, philosophers and lawyers. Many scientists, such as Galileo, have led forlorn hopes in defence of truth. In our own day and own country there have been men who have laid down their lives in the effort to discover through science the way to save their fellow men from suffering and disease; and science is seeking to salvage what it can of life, property and civilization from the holocaust which it had no hand in kindling.

I do not wish to cast opprobrium upon true religion, the religion of the Sermon on the Mount, which certainly gives no sanction to persecution or to the doctrine that might makes right. We must make every allowance for the spirit of the times, for ignorant religious zeal, for blind devotion to authority; but the fact remains that in all the celebrated cases, such as that of Galileo *vs.* Urban VIII., or those of Huxley *vs.* Gladstone and Huxley *vs.* Bishop Wilberforce, the balance not only of intellectual honesty, but of the Christian spirit of fairness, was overwhelmingly on the side of the scientists. I believe, moreover, that sober scientific judgment will ultimately convince mankind that the religion of the Sermon on the Mount, not that of the Hebrew God or of the Prussian God, is the necessary basis of an enduring civilization. This conviction certainly will never come from wrangling over creeds, rituals or articles of faith, nor by keeping such matters as Sunday observance and divorce in the ethical foreground.

It has sometimes been suggested—in fact, that was what Coleridge evidently intended to imply in the words quoted—that science is responsible in large measure for the great war and all its horrors. The claim that it contributed in any way to bring about the war is too fantastic to consider, for science has nothing to do with conquest, with commercial exploitation or with upholding the divine rights of dynasties. So far as the horrors of war are concerned, it is quite true that many of the results of scientific investigation have been applied to the work of destruction, but they have been so applied, not by scientists themselves, but by those whose position and power rest upon the traditions and the superstitions which science has always challenged. We must remember, moreover, that the same principles have been used to combat the perverted uses which have been made of them. Nothing can be more unfair than to attribute to science the unworthy uses of it that have been made for selfish purposes.

It seems sufficiently evident that science is not antagonistic to righteousness, and there is abundant reason to believe that it has a positive ethical value—that it is, indeed, the greatest ethical force of our time. The end of scientific investigation is to discover the truth about all things, so far as man is able to grasp it—the truth concerning not only the material things and phenomena of the universe, but also the truth concerning man's instincts and impulses and all the relations of human society, and the truth concerning the consequences to mankind of the conduct of men and of states. Religion may and should inculcate righteous zeal, but this impulse alone, no matter how intense and sincere it may be, does not necessarily enable us to distinguish between right and wrong, and may even make us all the more zealous in wrong-doing. To make an ethical decision we must see all the relations of the subject to ourselves and our fellow men, and see them disinterestedly, without prejudice and without regard to authority and tradition. This is a mental attitude which is essentially scientific, and which is consistently developed by scientific studies alone. As an illustration, let me mention my own early experience. In the southern states slavery was regarded as having divine sanction. Any teacher or preacher who taught otherwise was ostracized or banished. For years after the civil war this tradition survived, and I was taught and believed that the abolitionists had thwarted the purposes of God. While still a boy various scientific books fell into my hands. Not one of them mentioned slavery or considered any ethical questions, but they quickly brought about a change in my mental attitude which caused me to see that slavery was wholly bad—a wrong to the enslaved and evil in all its effects upon the slave holders—not bad from any *a priori* consideration, but because human experience had proved it to be so. Blindly its defenders had taken their stand on the ground of moral principle, when a searching self-analysis would surely have convinced them that the only consideration which determined their attitude was that of material self-interest; and a very short-sighted self-interest, overlooking the ultimate decadence of their civilization. John C. Calhoun, who received his early teaching from a Presbyterian minister, and who later received a classical and legal education, wrote: "We regard slavery as the most stable basis for free institutions in the world," and Judge Harper's legal training led him to the conclusion that "Nothing is more evident than that the institution of slavery is the cause of civilization." It would be impossible to imagine a man of scientific training making such palpably absurd statements as these. The fact is that no civilization tolerating slavery has ever endured; and that, in the words of John Stuart Mill, "slavery is incompatible with any high state of the arts of life and with any great efficiency of labor." Science did not flourish in the south—it is impossible to imagine that science and slavery could continue to coexist in the same community—but orthodox religions and classical scholarship have found nothing uncongenial in such association. It is well for us to ponder over such historical facts. There probably exist to-day among us evils as great as that of slavery. Our religious scruples are too easily overcome by self-interest; but science may open our eyes to the dangers that confront us.

Notwithstanding the lamentations of many that this is a degenerate age, when faced with the facts every one must admit that during the past thirty years there has been an immense improvement in the ethical standards of society. The political spellbinder has lost his grip; politics has in some measure been purified; official corruption has diminished; the standards of efficiency of our public officials have been raised; for the first time in our history the application of ethical principles to business affairs has made a little headway; we are beginning to question the perfection of our legal procedure; a new sense of civic responsibility and of our duty to our fellow men has been created, and we are acquiring new and higher ideals of patriotism and of international relations. This can hardly be the result of religious training, for this is generally acknowledged to have lost much of its efficacy; and furthermore, on the whole the influence of religious organizations has been conservative in all social and economic matters. They seem to consider that the antiquity of an institution or belief endows it with a vested ethical right to continued existence. It is probably more than a mere coincidence that the awakening from our moral stagnation began with the sudden increase of opportunities for education in high schools and colleges and the general introduction of scientific studies into these institutions. None of the formal sciences undertakes the consideration of ethical questions, but the common aim of all the sciences is to discover the truth, regardless of tradition, authority, prejudice or personal interest. The habit of mind thus acquired can hardly fail to influence conduct in all social relations. I believe that Huxley's words are profoundly true: "It is becoming less and less possible for the man who puts his faith in scientific methods of ascertaining truth, and is accustomed to have that faith justified by daily experience, to be consciously false to his principles in any matter." To illustrate, scientists are rarely political partisans. Probably none could be found who would approve the giving of public office as a reward for political service, and this not because of any special virtue, but because their mental habits cause them to see clearly the evils of such a system. It is the rule rather than the exception that politicians of the highest Christian professions, or with predominantly classical and legal training, defend or tolerate this practise. No doubt prescribed courses in science would do much to purify the political atmosphere.

It would surely promote the administration of justice to give every lawyer a sound scientific training. Can any one doubt that scientific methods of obtaining evidence would be more effective than those followed by the courts? Would it not be better for society if the prosecuting attorney and the attorney for the defence should have the common aim of ascertaining the exact facts in each case, with a view to obtaining a just application of the law, rather than to have the former determined to convict, and admitting only those facts which will help to convict, while the latter is even more determined to make use of every possible technicality or perversion of the facts in order that his client may escape merited punishment? How strange and wholly unscientific the logic by which the opposing lawyers can from identical premises deduce precisely opposite conclusions!

Economics is called a science, but it would seem that it might employ scientific methods more extensively with profit. There is probably some ground for the suspicion that this generation is fettered with economic dogmas as past generations were fettered with religious dogmas. It seems to me that the accepted laws of economics are fundamentally unscientific in so far as they give only partial recognition to the feelings which determine human conduct and to the influence of the conduct of individuals or of classes upon the general welfare of society. Political economy does not sufficiently take into account the qualities which differentiate men from the lower animals, and which should be recognized in any scientific study of the economic relations of men to each other—or rather, it makes a differentiation wholly in favor of the lower animals by assuming that man is dominated solely by a selfishness rarely found among brutes and a greed for material possessions which they wholly lack. As a result men of naturally good impulses are sometimes swayed from their better impulses under the compulsion of what they are told are inexorable laws of nature. To justify this impression, let me quote an early definition by John Stuart Mill:

> Political economy is concerned with man only as a being who desires to possess wealth. . . . It makes abstraction of every other human passion or motive. . . . It considers mankind as occupied solely in acquiring and consuming wealth.

Walker summarizes the attitude of the English school of economists in these words:

> The end of wealth man never fails to desire with a steady, uniform, constant passion. Of every other human passion or motive political economy makes entire abstraction. Love of country, love of honor, love of friends, love of learning, love of art, pity, shame, religion, charity, will never, so far as political economy cares to take into account, withstand the efforts of the economic man to amass wealth.

It would seem that the economic man is not a very desirable citizen. Mill later in his life rose to a higher level in his "Principles of Political Economy," which is a social philosophy giving some weight to the considerations which affect the highest welfare of society. There is probably a wide diversity of opinion among economists of the present day, but I am under the impression that teachers and leaders in business and law-making usually adhere to the principles set forth in Walker's summary. If these are indeed the principles which have governed the economic life of civilized countries, we need not wonder at the industrial and economic ills which seem to grow more acute as the years go by and the crowding of population makes the individual more and more dependent upon his fellows for opportunities of existence, development and happiness. Perhaps a more comprehensive scientific view—one which this war has already done much to advance—may some day give us a political economy which has for its end the welfare of society at large rather than that of the limited class of individuals who control the means of production and can at will increase their wealth at the expense of the majority of mankind. This new political economy may convince us that the principle of *laissez faire* leads to anarchy, that the law of supply and demand may be controlled to man's uses as we control the law of gravitation, and that only those are worthy of liberty who are ready to make a free-will offering of it on the altar of social welfare.

In less enlightened times science was attacked because it contradicted what was regarded as divine revelation. The most orthodox will now admit that science was right in regard to these questions, but many still maintain that it is antagonistic to spirituality and beauty. If this is true, it must be because spirituality and beauty are attributes of supernaturalism, not of naturalism—because nature is ugly and sordid, so that only violations of natural law can make a legitimate appeal to man's nobler feelings. It is true that scientists study material things, but they are a part of the universe. Does God repent having made this universe? If so, why does he not destroy it as an unclean thing? If mind and soul are not degraded by their residence in the material body, why should it be considered degrading to study that body? Of late much scandal among the godly has been created by the speculations of some scientists as to the possibility that mental processes are direct consequences of physical and chemical changes. This is still an open question, but it is difficult to see why it has any more religious bearing than the Copernican theory, to which the churches have become reconciled. Behind these physical and chemical changes there is a first cause—call it God if you will—which no human mind can fathom or explain. It seems rather rash to assume that the powers of this God are so limited that he could not make a self-directing universe in which thoughts and emotions are determined by the interplay of atoms, as our bodily movements are directed by muscular contractions. Surely such a creator would deserve more admiration than would one who had bunglingly constructed a universe to which he must constantly lend a hand to keep it going. Although the scientist studies material things, there is perhaps no other class of men so unworldly, so little diverted from their life work by the temptations of wealth or power, idle pleasures or bodily comfort. No man is more impatient than he with narrow views concerning practicality or with the notion that the chief end of science is the invention of machines or industrial processes for man's material comfort and aggrandizement.

The boundaries of science will always be enlarged by specialists who will in many cases be so engrossed in their work that they may be justly criticized for narrowness—but we often find specialists in art, literature and religion who are likewise deficient in Greek symmetry. Nevertheless, the scientists will always receive more censure, because his narrowness is not so like the narrowness of the average man as that of the workers in other fields, who are concerned with things more specifically human. But the good to humanity at large, which is our chief concern, comes not from the training of the specialist, but from the residual effects of various subjects upon the minds and conduct of those who study them. Certainly we must grant that the humane studies, which touch most closely upon man's intercourse with his fellows and with his esthetic enjoyments, are the indispensable basis of a sound education, but much of man's capacity for using his reason in the problems affecting his own life, including ethical problems, will surely be lost without some acquaintance, not so much with the facts of science, as with the method by which science attains demonstrated truth. Many of the opinions and institutions which society has inherited must be taken with a grain of salt. Science is the saving salt; but it does not follow, because a little salt is a good thing, that a diet exclusively of salt will be better.

In this discussion it has been necessary to refer to some of the limitations of formal religion, which claims the custodianship of ethics, and of the humane studies which make spirituality and beauty their aim, for the purpose of showing that science may be of help to both in realizing their ideals of the true, the beautiful, and the good. There has been no intention to decry genuine religion or to deny the fundamental importance of humane studies. The necessary basis of the most effective education must be the studies concerned with immediate human relations, the rules of conduct, the languages, the literatures, the arts, which spiritualize and beautify our lives and enable us to share them richly with others. But we can not exclude science with impunity, for if we do we shall surely lose much of the significance of the humane studies, and we shall fail to establish the highest criterions of conduct unless we see clearly the truths and understand the relationships which it directly or indirectly puts us into the attitude to perceive. The past has bequeathed to us a precious heritage of thought and of beauty, and among those long dead are many whose intellectual and spiritual authority will live for all time; but we have also inherited traditions which fetter our minds and souls, and institutions which weigh heavily upon us. Each generation must challenge the validity of the beliefs and institutions which the past would impose upon it, and they must justify their claims to continued existence. The humane studies make us familiar with the treasures of the past, but they also sometimes render us unduly subservient to authority and tradition. Science inculcates the questioning and discriminating spirit; it respects no tradition that does not justify itself to reason, and listens to no authority which can not demonstrate its validity. It cultivates the open mind which is ready to accept new truths and the discriminating mind which presents their too hasty acceptance. Most people who have had some scientific training will quickly forget the details of the sciences they have studied, but the effect of the scientific method upon their minds will rarely be completely effaced. This method is simple and direct, and makes no use of the dialectic subtleties with which lawyers, theologians and philosophers have so often deluded themselves and their disciples.

Many great humanists have recognized the important part played by science in the ethical development of civilization. In "The Hope of the Great Community" Royce writes:

> Some motives which tend to render the genuine Pauline charity, the genuine love of the unity of the great community to which all civilized men may, when enlightened, consciously belong—such motives, I say, have been furthered by the arts, the industries, the sciences and the social developments of the nineteenth and twentieth centuries as thousands of years of previous activity have never furthered them. . . . How far reaching the abundant phases of human life are tending to become under the influence of those humane arts and sciences which of late have so successfully combated disease and brought together nations and men who once could not in the least feel their brotherhood.

Matthew Arnold was not over-partial to science, and rendered great service in criticizing the over-zealous claims of some of its adherents, but he clearly saw its place in liberal culture. He wrote:

> Hard unintelligence must be supplied and reduced by culture, by a growth in the variety, freshness, and sweetness of our spiritual life; and this end can only be reached by studying things that lie outside ourselves, and by studying them disinterestedly. Let us unite ourselves with our better mind and with the world through science.

Religion and philosophy, literature and art, history and science, each in due proportion plays its part in the intellectual and moral development by which alone we can understand and express the best that is ourselves and in the world. Each helps to show the path of wisdom, righteousness and fruitful living to him who seeks it, but none of them can help him who lacks the desire or the will to do right. Granted this inclination, I believe that the habit of mind which is developed by scientific studies is at least as important an ethical agency as the others, and I am inclined to think that in the present stage of civilization it is the most important. The scientist has the same human failings as other people; he may have no better intentions nor be no more righteous-minded than they; but he can sometimes act more intelligently in carrying out his good intentions. Science teaches us to seek the truth without prejudice; it develops the habit of disinterestedness; it leads us to consider all known elements in making ethical judgments; it prompts us to seek the amelioration of the health, the well-being, the happiness, of our fellow men; it diverts our vision from the fruitless contemplation of a past in which we can play no part to the present wherein lies our task; and it bids us to consider the future and the welfare of generations still unborn. The humanist seeks to perpetuate the wisdom and beauty of the past, and in doing this he renders no mean service; but he is apt to depreciate the present and to despair of the future, to forget that it is the task of each new generation to winnow the chaff from the gathered harvest and to plant the seed for new harvests. With the mutual sympathy and united efforts of humanism and science, civilization, firmly rooted in the past, may grow unhampered to its full fruition.

When this war is over it will be in a large measure the mission of science to rebuild a shattered civilization. It will restore the industries of nations; it will house the homeless, feed the hungry and cure the sick. But it will be even more potent in healing the deep-seated ills of society which are the consequences of past social misconduct, whether innocent or malicious. Good intentions and religious training, unaided by understanding, will not carry us far. Whatever good may come from prayer, intelligent men prefer to have their ailments treated by a physician who seeks the causes and cures of disease in a scientific manner, or the firm-handed surgeon whose knowledge of anatomy enables him to remove cancerous growths without killing the patient. It will be the task of men of scientific training or of scientific spirit to heal the wounds which have been wrought by the duplicities of statesmanship, by the selfishness of privileged classes, and by false philosophies and religions, and to remove malignant economic growths by radical operations. It is, I believe, the highest mission of science to contribute its part to the training of such men. The objective by-products of science, such as the telephone and the automobile, seem to me to be of relatively little importance; but its subjective influence on man's intellect and conduct is of the highest consequence. In universal scientific training in this larger sense lies the hope of democracy.

Science has much to contribute to the happiness of the world in a material way, and it is right that it should be encouraged in this work. No doubt the lessons of the war will convince our government, our educational institutions, and our industrial organizations that too much can not be done to stimulate the material applications of science. But there is a real danger that too much stress may be laid on these material aspects of research, which are not science, but only its by-products. Competent investigators should not only be provided with facilities for their work, but they should be absolutely unhampered by any demand that their researches should be of immediate practical utility; and it is equally important for the interests of society that teachers of science should lay more emphasis upon its intellectual and ethical significance. Much of the ineffectiveness of scientific teaching in this country, its failure to inspire interest and to win respect, is undoubtedly due to laying too much stress on its practical, vocational, or narrowly scientific aspects, rather than on its humanistic side.

There is a materialism which in every age, especially during times of great prosperity, has insidiously weakened the mental and moral fiber of mankind—a materialism of wealth, of self-indulgence, of inordinate luxury. This materialism thrives on modern industrialism, but it has an economic rather than a scientific basis, although science is often held responsible for its defects, because scientific discoveries have had such a wide industrial application. The primary object of applied science is not to create wealth for individuals, but to lessen the hardships, cure the bodily ills, and increase the legitimate comfort and happiness of mankind at large. If this is materialism the good Samaritan was a materialist. An unscientific political economy has made it possible for individuals to prevent the general diffusion of these benefits, to acquire fortunes which have in no sense been really earned by bodily or mental effort, and to bring about a condition of industrial servitude which can only result in a social upheaval unless it is corrected. It would be well if religion, humanism and science, with a sympathetic mutual understanding, would join in a united and unceasing attack upon this materialism, which is their common enemy.

Wealth has its worthy uses, but selfish greed for riches and power blinds man's spiritual eyes and causes him to strive for sordid and ignoble ends. Some scientists, in common with other human beings, have limited vision; but at the worst this vision is not directed to ignoble things and their aims are not selfish. They do not deny the existence or depreciate the value of the human attributes and aspirations which defy analysis in their laboratories. The aim of the scientist is to see clearly that which is, even though he cannot explain it; and he sees that the wages of sin is death for the individual or the state; that in mankind there is an instinct for the good, a reverence for self-sacrifice and moral heroism, for mercy and magnanimity, which is rarely completely suppressed in the worst of men; that men will die for immaterial ideals, and that the mysterious thing called beauty exercises a potent and wholesome influence over mankind. How these things came about and whither they tend he can not tell, but he knows that they are as real as the laws of mechanics, and that he, like other men, is swayed by them.

Intent upon his daily task, the individual scientist is hardly conscious that he has a creed, and could with difficulty define the forces which drive him. But there is a strong impelling force behind his activity. It is not a conscious ethical force, but neither is it a desire for wealth, popularity or power, nor for any wider recognition than that accorded by his fellow workers. This force is surely something more than idle curiosity; there is in it an element of devotion and of self-sacrifice, an impelling desire to contribute to the ultimate good of humanity in more than a material sense. Were he driven to make his aspirations articulate, he might formulate them in words not very different from those of St. Augustine:

> Let us not leave thee alone to make in the secret of thy knowledge, as thou didst before the creation of the firmament, the division of light from darkness; let the children of thy spirit, placed in their firmament, make their light shine upon the earth, mark the division of night and day, and announce the revolution of the times. The old order is passed, the new arises; the night is spent, the day is come forth; and thou shalt crown the year with thy blessing, when thou shalt send forth laborers into thy harvest sown by other hands than theirs, when thou shalt send forth new laborers to new seed times, whereof the harvest shalt be not yet.